

## **DATA COPY DEVICE**

### **Technical Field**

5       The present invention relates to a data copy device for use in copying data between two storage media connected to an IDE or IDE-compatible interface, and more particularly, to a data copy device that minimizes the duty of a control module and the use of memory and has an enhanced copying speed about twice as fast as a conventional data copy device.

### **Background Art**

10       Conventionally, a device for providing a data copy function between two storage media has been used for the purpose of data backup or the like. For example, an external hard disk, ASKA Tripper USB20PS1, recently released onto the market by ASKA in Japan, is a typical example of the data copy device. The ASKA Tripper USB20PS1 provides an additional slot adapter for a CF memory card, a smart media, a memory stick, an MMC card, an SD card and the like, thereby providing a function by which data are backed up from a variety of memory modules used by a digital camera and the like to an internal hard disk.

20       Fig. 1 is a block diagram illustrating a configuration of a conventional data copy device where a source medium 140 and a target medium 150 are connected to a control module 110 through an IDE interface 130. It is assumed herein that data are copied from the source medium 140 to the target medium 150. In view of the properties of the IDE interface 130, the source medium 140 and the target medium 150 share the same IDE bus and are identified only by different device numbers. In order to perform data copy, the control module 110 reads data from the source medium 140 and temporarily stores the data in a memory 120, and then reads data again from the memory 120 and writes the data in the target medium 150.

25       According to the conventional data copy device, two read operations and two write operations should be performed to copy data from the source medium 140 to the target

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medium 150. Thus, there is a problem in that the data copying speed is low as a whole. Furthermore, in order to enhance the performance of data copy felt by a user, a buffer memory 120 with considerable capacity should be prepared and a high performance control module 110 should also be used. Therefore, there is a problem in that the price of a product inevitably becomes high.

### Disclosure of Invention

An object of the invention is to provide a data copy device for use in copying data between two storage media connected to an IDE or IDE-compatible interface, wherein the duty of a control module and the use of memory can be minimized and an enhanced copying speed about twice as fast as a conventional data copy device can be achieved.

### Brief Description of Drawings

Fig. 1 is a block diagram illustrating a configuration of a conventional data copy device.

Fig. 2 shows a function allocation address table according to IDE specifications.

Figs. 3a and 3b are block diagrams illustrating configurations of data copy devices according to embodiments of the present invention.

Fig. 4 is a flowchart illustrating the operation procedure of a data copy device according to an embodiment of the invention.

### Best Mode for Carrying Out the Invention

Hereinafter, embodiments of the present invention will be described in detail with reference to the accompanying drawings.

Fig. 2 shows a function allocation address table 200 according to IDE specifications. The operation procedure of accessing a source medium 140 and a target medium 150 by a control module 110 will be explained in greater detail.

The control module 110 is connected to the source medium 140 and the target medium 150 through an IDE interface 130 and operates the media as required. Specifically, the control module selects and accesses a specific storage medium 140 or 150, which is

currently connected to an IDE bus, by using signal lines CS[1:0] and AD[2:0] of an IDE bus, and then performs operations such as device control, device status monitoring, and data read/write on the selected storage medium. Fig. 2 shows an address table for performing such operations.

5 For example, a case where the control module 110 reads data from a specific physical area of the source medium 140 will be explained. First, the control module 110 sets up parameters by accessing a Command Block Register. Since the source medium 140 is connected to DEVICE 0, as shown in Fig. 1, the Device field at the address of [A, N, 1, 1, 0] is set to '0', and the address of the specific physical area is set in Sector Count, Sector  
10 Number, Cylinder Low, Cylinder High, and Head fields.

Next, a value corresponding to READ is set in the Command register at the address of [A, N, 1, 1, 1], and it is confirmed whether the source medium 140 is in Ready state by reading the Alternate Status register at the address of [N, A, 1, 1, 0] or the Status register at the address of [A, N, 1, 1, 1]. If the source medium 140 is in Ready state, the  
15 address of CS[1:0], AD[2:0] is finally set to Data state, i.e., [A, N, 0, 0, 0], and a DIOR signal is sent to the source medium 140, so that data read is accomplished as desired. Meanwhile, in case of data write, the operation is very similar to the data read operation. However, a DIOW signal is sent to a medium in the last step.

20 Figs. 3a and 3b are block diagrams illustrating configurations of data copy devices according to embodiments of the invention.

An embodiment shown in Fig. 3a will be first described. Contrary to the prior art shown in Fig. 1, signal lines D[15:0], AD[2:0] and CS[1:0] of the IDE bus are connected in common to the source medium 140 and the target medium 150, but signal lines DIOR and DIOW for data input/output are connected to the source medium and the target medium  
25 through an intermediate switch module 310. That is, in the prior art shown in Fig. 1, a signal combination (DIOR, DIOW) is connected in common to data read/write signal combinations (rd\_0, wr\_0) and (rd\_1, wr\_1) for the source medium 140 and the target medium 150. In the present invention shown in Fig. 3a, however, the signal combination is connected directly to the data read/write signal combination (rd\_1, wr\_1) for the target  
30 medium 150 and is switch connected to the data read/write signal combination (rd\_0,

wr\_0) for the source medium 140 via the switch module 310.

The switch module 310 will be described in greater detail below. In response to an external selection input *sel*, the module outputs an input signal combination (x0, y0) (if *sel* = 0) or an input signal combination (x1, y1) (if *sel* = 1) to output terminals x2 and y2. In the configuration shown in Fig. 3a, a data input/output signal combination (DIOR, DIOW) is connected to input terminals x0 and y0, a data input/output signal combination (DIOW, DIOR) is connected to input terminals x1 and y1, and a data read/write signal combination (rd\_0, wr\_0) for the source medium 140 is connected to output terminals x2 and y2. Accordingly, when the external selection input *sel* is '0', the signal combination (DIOR, DIOW) is provided as the signal combination (rd\_0, wr\_0) for the source medium 140 so that a normal medium access operation is performed. When the external selection input *sel* is '1', the signal combination (DIOW, DIOR) is provided as the signal combination (rd\_0, wr\_0) for the source medium 140 so that a data copying operation is performed according to the invention.

The external selection input *sel* to the switch module 310 is, for example, determined by an output port *control\_p0* of the control module 110. In the data copy device according to the present invention, while internal registers are set and read through access to the source medium 140 and target medium 150, the external selection input *sel* is set to '0'. While data are actually copied from the source medium 140 to the target medium 150, the external selection input *sel* is set to '1'. In the embodiment shown in Fig. 3a, if the external selection input *sel* is set to '1' and a write operation is performed, data are copied directly without intervention of the control module 110 as desired. The operation of the data copy device shown in Fig. 3a will be described in detail with reference to the flowchart of Fig. 4.

Fig. 3b is a block diagram illustrating another embodiment according to the present invention. This embodiment is different from the embodiment of Fig. 3a in that signal lines DIOR and DIOW for data input/output are connected directly to the source medium 140 but connected to the target medium 150 via the switch module 310. In the embodiment of Fig. 3b, if the external selection input *sel* is set to '1' and a read operation is performed, data are copied directly without intervention of the control module 110 as

desired. The detailed operation of the data copy device illustrated in Fig. 3b will also be described in detail with reference to the flowchart of Fig. 4.

Fig. 4 is a flowchart illustrating the operation procedure of copying data from the source medium 140 to the target medium 150 in a data copy device according to an embodiment of the invention, which is applicable commonly to the embodiments illustrated in Figs. 3a and 3b. First, the external selection input *sel* of the switch module 310 or 320 is set to '0' (ST410), whereby a data input/output signal combination (DIOR, DIOW) is connected in common to data read/write signal combinations (rd\_0, wr\_0; rd\_1, wr\_1) for the source medium 140 and target medium 150. Accordingly, the control module 110 can normally access the source medium 140 and the target medium 150 via the IDE module 130.

Then, the control module 110 determines the operational parameters for the source medium 140 and the target medium 150 (ST420). This process was described above with reference to Fig. 2. That is, the operational parameters, which relate to physical locations and ranges for a read or write operation at the source medium 140 and the target medium 150, such as values of Device/Head, Sector Count, Sector Number, Cylinder Low and Cylinder High, are set. At this time, the Command register located at the address of [A, N, 1, 1, 1] is set to READ-mode for the source medium 140 and set to WRITE-mode for the target medium 150.

Next, it is confirmed whether both the source medium 140 and the target medium 150 are in Ready state by reading the Alternate Status register at the address of [N, A, 1, 1, 0] and the Status register at the address of [A, N, 1, 1, 1] for the source medium 140 and the target medium 150 (ST430), whereby the source medium 140 is ready to read data at an assigned physical location and the target medium 150 is ready to write data at an assigned physical location. Thereafter, addresses for the source medium 140 and the target medium 150 are set to [A, N, 0, 0, 0], so that both the source medium 140 and the target medium 150 are set to a data read/write-enabled state (ST440).

Then, the external selection input *sel* to the switch module 310 or 320 is set to '1' (ST450). Thus, as described above, crossed data input/output combination signals are provided to the source medium 140 and the target medium 150 by the switching operation

of the switch module 310 or 320. That is, in the embodiment configured as shown in Fig. 3a, combination signals (DIOW, DIOR) and (DIOR, DIOW) are provided to the source medium 140 and the target medium 150, respectively, whereas in the embodiment configured as shown in Fig. 3b, combination signals (DIOR, DIOW) and (DIOW, DIOR) are provided to the source medium 140 and the target medium 150, respectively.

Next, a READ operation (in case of the embodiment illustrated in Fig. 3b) or a WRITE operation (in case of the embodiment illustrated in Fig. 3a) is initiated, so that a combination signal for read control is provided to the source medium 140 and a combination signal for write control is provided to the target medium 150, thereby simultaneously performing a data read operation and a data write operation. That is, in the embodiment of Fig. 3a, the control module 110 provides a data write signal DIOW through the IDE module 130. At this time, with the switching operation of the switch module 310, a data read signal *rd\_0* is input into the source medium 140 so that the source medium 140 reads data under predetermined conditions and outputs the data to a data bus D[15:0], while a data write signal *wr\_1* is input into the target medium 150 so that the target medium 150 writes the data, which is on the data bus D[15:0], therein under predetermined conditions. Consequently, the data are copied from the source medium 140 to the target medium 150.

In addition, in the embodiment of Fig. 3b, the control module 110 provides a data read signal DIOR through the IDE module 130. At this time, with the aforementioned switching operation of the switch module 310, a data read signal *rd\_0* is input into the source medium 140 so that the source medium 140 reads data under predetermined conditions and outputs the data to the data bus D[15:0], while a data write signal *wr\_1* is input into the target medium 150 so that the target medium 150 writes the data, which is on the data bus D[15:0], therein under predetermined conditions. Consequently, the data are copied from the source medium 140 to the target medium 150.

Meanwhile, in the embodiments of Figs. 3a and 3b, when the signals DIOW and DIOR are simultaneously provided as the read signal *rd\_0* for the source medium 140 and the write signal *wr\_1* for the target medium 150, data are copied as required. Here, it is considered that there is no particular restriction on the other signals, i.e., a write signal

*wr\_0* for the source medium 140 and a read signal *rd\_1* for the target medium 150. Therefore, the switch modules 310 and 320 of Figs. 3a and 3b are preferred embodiments of the present invention, and it should be understood that switch modules can be configured variously without departing from the scope and spirit of the present invention.

5       The internal control operation of the data copy device according to the present invention will be described conceptually. The source medium 140 and the target medium 150 are set to READ-mode and WRITE-mode, respectively; the control signal *sel* for the switch module 310 is set to '1'; a read operation or a write operation is performed according to the switching configuration; and the data, which have been output by the  
10       source medium 140 and is on the data bus D[15:0], are copied directly to the inside of the target medium 150. However, depending on the source medium 140 and the target medium 150, problems may arise if the aforementioned control operations are applied as they are. Possible problems and solutions for the problems will be described below.

      That is, the source medium 140 and the target medium 150 are sequentially set to  
15       READ-mode and WRITE-mode. Here, there is a possibility that the medium 140 or 150 which has been first set will have an error while operating in DATA mode, contrary to the foregoing. For example, in the embodiment of Fig. 3a, if it is assumed that the source medium 140 is first set to READ-mode and the write medium 150 is then set to WRITE-mode, there is a possibility that the source medium 140 will understand that access to itself  
20       has been completed when the control module 110 sets the write medium 150 to WRITE-mode. In such a case, even though a data read signal *rd\_0* is provided by initiating a write operation in step ST460, an actual read operation is not performed.

      Likewise, even if the write medium 150 is first set to WRITE-mode and the source medium 140 is then set to READ-mode, there is a possibility that the write medium 150  
25       will understand that access to itself has been completed when the control module 110 sets the source medium 140 to READ-mode. In such a case, even though a data write signal *wr\_1* is provided by initiating a write operation in step ST460, an actual read operation for the data on the data bus D[15:0] is not performed while the *wr\_1* signal is ignored. These problems arise because all devices connected to the IDE bus can gain access in common to  
30       the IDE bus signal in view of the properties of the IDE interface, and thus, there is a

medium device that determines its own operation mode by considering the contents of access of the other devices.

Accordingly, to secure a stable data copying operation, it is preferred that more or less modifications be made to the configuration of the present invention, which has been  
5 described with reference to Figs. 3a to 4. For example, it is possible to consider a method of using a chip select signal. Among signals provided to the source medium 140 and the target medium 150 through the IDE bus, although not shown in Figs. 3a and 3b, there is a chip select signal that is generally provided in common to both the source medium 140 and the target medium 150. Since all signals provided while the chip select signal is inactive  
10 are ignored by the subject medium 140 and/or 150, the aforementioned problems can be solved using the chip select signal.

That is, the control module 110 prepares an additional ENABLE signal and provides the ENABLE signal in combination with the chip select signal, whereby upon subsequent setting of a mode, the chip select signal for the subject medium 140 or 150 to  
15 which the mode setting has been first made can become inactive. Detailed description thereof will be made with reference to the embodiments described above. In the case where the source medium 140 is first set to READ-mode and the target medium 150 is then set to WRITE-mode, the chip select signal for the source medium 140 to which the mode setting has been first made is provided in logical combination with the ENABLE  
20 signal by means of AND or OR logic. The control module 110 controls the ENABLE signal in advance when setting the medium 150 to WRITE-mode, so that the chip select signal for the source medium 140 can be set to an inactive state. In this case, the source medium 140 set to the inactive state ignores completely all the contents of mode setting of the medium 150, thereby removing the possibility of occurrence of the aforementioned  
25 problems.

Meanwhile, it is also possible to employ a method in which the ENABLE signal is combined with the DIOW signal and the DIOR signal rather than the chip select signal but the other operations are identical to those of the aforementioned method using the chip select signal. In case of using the method of combining the ENABLE signal with the  
30 DIOW signal and the DIOR signal, the subject medium 140 or 150 is in an active state but



is actually disabled due to the combination of the DIOW signal and the DIOR signal with the ENABLE signal. Thus, the subject medium is set to a state where it is considered that there is no data input/output, thereby obtaining the same results as the method of employing the chip select signal.

5           Although the technical spirit of the present invention has been described herein based on the IDE interface, it should be understood that the application and scope of the present invention are not limited only to the IDE interface but include various other data copy devices using IDE-compatible interfaces. Accordingly, the term 'IDE interface' used herein including the claims should be construed as meaning 'IDE interface or IDE-

10 compatible interface'.

In addition, for the sake of clarity of the spirit of the present invention, the control module 110, the IDE interface module 130 and the switch module 310 or 320 are illustrated as being separately provided. However, some or all of these components may be designed to be incorporated into a single chip. It should be noted that all these

15 modifications and variations fall within the scope of the present invention.

#### Industrial Applicability

According to the data copy device of the present invention, there are advantages in that a product can be constructed of a control module having minimal performance and the

20 minimum capacity of memory, resulting in reduced production costs and a high data copying speed.